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RESEARCH ARTICLE

FACTORS AFFECTING LONGEVITY OF TRICUSPID VALVE REPAIR.

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Abstract

Background: Severe tricuspid regurgitation (TR) is an independent predictor of long-term mortality. Although TR is tolerated for many years, it will eventually lead to severe decompensated heart failure and death. The 1-year survival rate in patients with severe TR is 65%, whereas that in patients without TR is 90%.

Methods: This survival retrospective and prospective study included 199 patients (66 male [33.2%] and 133 female [66.8%]) who underwent tricuspid valve repair at King Abdulaziz Cardiac Center, Riyadh, Saudi Arabia, from January 1999 until December 2012. The mean age at operation was 49.7 years SD 16.3. All patients received follow-up until February 2016. We collected data on patient demographics, family history of cardiac diseases, smoking history, patient health status and other co-morbidities prior to the operation, the surgical technique, and other associated procedures carried out during the same operation. We included echocardiograph (ECHO)results obtained pre-operation, post-operation, pre-discharge, and at the final follow-up (February 2016). Cox regression analysis (univariate and multivariate) was used to study patient survival factors.

Results: The final outcomes of the operation showed 84.5% survival. The median survival time was 50 months and interquartile range 72. All patients underwent concomitant procedures such as coronary artery bypass grafting (19.1%) or other valve replacement surgeries (23.1%). The surgical technique was chosen based on the patient's status and the surgeon's preference. The mean hospital stay was 26.9 ± 19.3 days, which was prolonged by surgical complications. Elderly patients, prior cardiac surgery, and abnormal coronary angiogram were linked to poor prognosis ($p \leq 0.05$). ECHO follow-up showed improvement in the functional status of the tricuspid valve.

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Conclusion: The tricuspid valve requires surgical intervention whenever possible so as to minimize fatal consequences. Our study revealed positive enhancement of valve function following surgery.

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Background:-

Tricuspid regurgitation (TR) is increasingly recognized as a significant valvular disorder with serious clinical consequences. Severe TR is an independent predictor of long-term mortality. Although TR is tolerated for many years, it will eventually lead to severe decompensated heart failure and death. The 1-year survival rate in patients with severe TR is 65%, whereas that in patients with no TR is 90%.[1] In clinical practice, there is marked inconsistency regarding indications, timing, and techniques of tricuspid valve repair, with variability in the final outcome. Gatti et al. reported an improvement in tricuspid valve dilatation after surgery,with respect to TR, with the estimated freedom from all-cause death being 77.8% for 10 years.[2] McCarthy et al. reported the experience of the Cleveland Clinics in tricuspid valve repairs in 2004. They showed a high level of early recurrence of significant TR (14%) a week after tricuspid valve repair. In addition, their results suggested that the risk factors for worsening regurgitation are higher pre-operative regurgitation grade, poor left ventricular function, permanent pacemaker, and repair type other than ring annuloplasty.[3] In 2008, Guenther et al. reported their 30 years' experience with tricuspid valve surgery (repair and replacement). In their study, they reported a high (18.8%) postoperative mortality for tricuspid valve surgery.[4] In 2010, Fadel determined the short- and long-term outcomes after triple valve replacement (aortic, mitral, and tricuspid valves). Their results for 206 patients showed that aortic and mitral valves usually underwent replacement (>70%) and tricuspid valve usually underwent repair (91%). The study showed that operation mortality prior to hospital discharge was 11% and the 15-year survival rate was 68%. In addition, they reported that advanced age was one of the major risk factors for high mortality.[5] In 2013, Al-Atassi et al. published a literature review that concluded according to the available evidence that severe tricuspid valve regurgitation should be repaired whenever possible.[6] Therefore, for patients with TR, it is important to consider at the time of decision-making the risk factors (modifiable and non-modifiable) that might influence the outcome of any planned surgical intervention.Moreover, surgeons need to individualize patient plans in order to improve the short- and long-term outcomes and to minimize the likelihood of recurrence of TR.

Methodology:-

This was a survival retrospective and prospective study including all cases of tricuspid valve repair done at King Abdulaziz Cardiac Center, Riyadh, Saudi Arabia from January 1999 until December 2012. Subjects included in this study were followed-up until February 2016. We collected data on patient demographics, family history of cardiac diseases, smoking history, patient health status together with other co-morbidities prior to the operation, echocardiographic (ECHO) findings (pre- and post-operation), surgical techniques, and other associated procedures performed during the same operation. This information was obtained from the Cardiac Surgery Database, in addition to direct patient chart review. Patients were followed-up postoperatively with ECHO during regular hospital visits. Visits were scheduled according to patient need and physician preference. We included and compared the ECHO carried out pre-operation, post-operation, pre-discharge, and at final follow-up. Cox regression analysis (univariate and multivariate) was used to study patients' survival factors. Final outcomes of changes in tricuspid valve across time and patient survival were reported. This study was approved by the institutional review board of King Abdullah International Medical Research Center, Riyadh, Saudi Arabia.

Results:-

We included 199 patients (66 male [33.2%] and 133 female [66.8%]) in this study. The mean age at operation was 49.7 years SD 16.3. The final outcomes of the operation showed 84.5% survival. The median survival time was 50 months and interquartile range 72 (Figure 1). Patients' characteristics are presented in Table I, and all co-morbidities are described in Table II. All patients underwent concomitant procedures such as coronary artery bypass grafting (CABG), mitral valve repair/replacement, and/or aortic valve repair/replacement (Table III). The surgical technique selectedwas based on the patient's status and the surgeon's preference (Table IV). Some patients underwent a combination of techniques, but the effect of this was not measured. The mean hospital stay was 26.9 ± 19.3 days, which was prolonged in patients who experienced surgical complications (Table V). Patients who experienced arrhythmia, pneumonia, and/or other infections tended to stay in hospital for a longer period. Paired difference

analysis tests were used to report the positive significant difference with regard to improvement of tricuspid valve function over time. The performance of the target tricuspid valve was followed up by ECHO (Table VI). Cox regression analysis (univariate & multivariate) represents the survival rate (Table VII, Figure 2). Survival outcomes are summarized in Table VIII.

Table I:- Patient Characteristics

Characters	n = 199	(%)
Male	66	33.2
Female	133	66.8
Family History of Cardiac Disease	9	4.5
Smoker	14	7
Mean Body Mass Index		27.08 ±7.45
Under-weight	20	10.1
Normal	60	30.2
Over-weight	61	30.7
Obese	58	29.1
Abnormal Angiogram Finding	149	74.9
Abnormal ECG Finding	160	80.5

Table ii:- co-morbidities.

Disease	n = 199	(%)
Hypertension	83	41.7
Diabetes Mellitus	76	38.2
Ischemic Heart Disease	35	17.6
Rheumatic Heart Disease	88	44.2
Congestive Heart Failure	44	22.1
Pulmonary Diseases	31	15.6
Dyslipidemia	59	29.6
Pulmonary Hypertension	42	21.1
Chronic Kidney Disease	15	7.5
Stroke	19	9.5

Table III: Associated Procedure

Procedure & Technique	n = 199	(%)
Mitral Valve Repair	46	23.1
Mitral Valve Replacement	125	62.8
Aortic Valve Replacement	39	19.6
CABG	38	19.1
Maze Procedure	60	31.3

Table IV: Surgical Technique

Procedure & Technique	n = 199	(%)
Kay repair	114	57.3
De Vega	22	11.1
Commissurotomy	21	10.9
Ring	46	23.1

Table V: Hospital Stay

Variable	Mean (±SD)	n = 199 (100%)	P value
Age	49.71 (16.35)		0.001
Gender			
Male	27.02 (23.57)	66	0.97
Female	26.91 (16.91)	133	
Smoking History			
Yes	31.07 (23.83)	14	0.409

No	26.62 (19.02)	185	
Previous Cardiac Surgery			
Yes	26.55 (12.99)	66	0.838
No	27.15 (21.99)	133	
Heart Failure			
Yes	36.02 (27.04)	43	0.009
No	24.36 (15.74)	156	
Ischemic Heart Disease			
Yes	31.29 (21.30)	45	0.08
No	25.63 (18.62)	154	
CABG			
Yes	29.37 (20.66)	38	0.391
No	26.35 (19.06)	161	
Complicated by Pneumonia			
Yes	47.72 (40.42)	18	0.028
No	24.69 (14.29)	181	
Complicated by Bleeding			
Yes	30.73 (21.19)	22	0.318
No	26.33 (19.12)	177	
Complicated by Infection			
Yes	35.69 (20.46)	49	0.000
No	23.82 (18.07)	150	
Complicated by Arrhythmia			
Yes	29.16 (18.11)	115	0.043
No	23.41 (20.71)	84	
Significant P value, <0.05			

Table VI: ECHO follow-up of the tricuspid valve

Regurgitation grade	Trace	Mild	Moderate	Severe	Compere Test	P value
Pre-Surgery	3%	4.2%	47%	45.8%	Friedman's	0.000
Post-Surgery	43.2%	25.9%	19.4%	11.5%		
Valve Annular Diameter	Mean Anterior-posterior (Pre-Surgery)		Mean Anterior-posterior (Post-Surgery)			
	3.71 ± 0.72		3.14 ± 0.67		Shapiro–Wilk	0.000
	Abnormal T.A.P.S.E (Pre-Surgery)		Abnormal T.A.P.S.E (Post-Surgery)			
	32.7%		38.6%		Cochrane's Q	0.142
Rt. Ventricular Dilatation						
	Fraction Area Change	Mild	Moderate	Severe		
Pre-Surgery		77%	17.7%	4.9%	Friedman's	0.000
Post-Surgery		85.8%	12.1%	2.1%		
	RV Systolic Function	Normal	Mild	Moderate		
Pre-Surgery		70.9%	12.7%	16.3%	Friedman's	0.062
Post-Surgery		62%	21.1%	16.9%		
T.A.P.S.E; Tricuspid annular plane systolic excursion						

Table VII: Cox Regression Survival Analysis

Variable	Univariate Model	P value	Multivariate Model	P value
Age	1.04 (1.01, 1.08)	0.010	1.16 (1.05, 1.27)	0.002
Gender	0.83 (0.29, 2.31)	0.722	0.34 (0.03, 3.26)	0.355
Smoking History	1.31 (0.17, 9.88)	0.789	0.01 (0.000, 1.41)	0.071
Weight	0.96 (0.97, 1.02)	0.740	0.98 (0.94, 1.03)	0.565
Previous Cardiac Surgery	5.20 (1.19, 22.70)	0.028	49.1 (3.55, 678.8)	0.004
Normal ECG	1.17 (0.47, 2.91)	0.722	6.25 (0.71, 54.7)	0.098
Normal Angiogram	2.69 (0.62, 11.66)	0.185	45.2 (3.01, 678.7)	0.006
Hypertension	0.55 (0.22, 1.37)	0.202	0.89 (0.13, 5.89)	0.909
Heart failure	0.43 (0.17, 1.11)	0.084	0.63 (0.10, 3.89)	0.624
Rheumatic Heart Disease	1.41 (0.55, 3.60)	0.464	7.79 (1.05, 57.7)	0.044
Ischemic Heart Disease	0.55 (0.20, 1.48)	0.239	0.53 (0.01, 16.02)	0.715
Pulmonary Hypertension	0.61 (0.22, 1.73)	0.363	0.09 (0.01, 0.96)	0.047
Pulmonary Disease	0.78 (0.22, 2.70)	0.698	1.11 (0.17, 6.98)	0.911
Dyslipidemia	0.57 (0.22, 1.46)	0.245	0.77 (0.11, 5.37)	0.798
Diabetes Mellitus	1.02 (0.39, 2.65)	0.959	42.7 (2.54, 719.2)	0.009
Stroke	0.93 (0.21, 4.09)	0.931	0.10 (0.003, 3.22)	0.196
Chronic Kidney Disease	0.24 (0.07, 0.74)	0.014	0.01 (0.000, 0.66)	0.029
Maze Procedure	0.79 (0.30, 2.05)	0.635	0.14 (0.02, 0.84)	0.032
Kay Repair	1.36 (0.54, 3.44)	0.507	3.67 (0.75, 17.8)	0.106
De Vega	0.43 (0.14, 1.33)	0.147	0.49 (0.07, 3.28)	0.469
Commissurotomy	1.007 (0.23, 4.38)	0.993	0.98 (0.08, 11.3)	0.993
Mitral Repair	0.64 (0.22, 1.81)	0.404	13.3 (0.57, 311.7)	0.106
Mitral Replacement	1.28 (0.49, 3.32)	0.610	9.27 (0.43, 196.1)	0.153
Aortic Replacement	0.63 (0.22, 1.76)	0.379	0.03 (0.004, 0.39)	0.006
CABG	0.57 (0.20, 1.62)	0.298	1.24 (0.05, 29.7)	0.891
Complicated by Pneumonia	0.43 (0.12, 1.50)	0.188	0.07 (0.005, 1.17)	0.065
Complicated by Bleeding	0.89 (0.20, 3.87)	0.877	0.97 (0.05, 16.8)	0.984
Complicated by Infection	0.48 (0.18, 1.25)	0.135	0.34 (0.05, 2.07)	0.244
Complicated by Arrhythmia	1.005 (0.38, 2.59)	0.992	0.55 (0.08, 3.59)	0.534

Table viii: survival time

Period	N = 199	(%)
One Month	177	88.9
One Year	146	73.4
Five Years	78	39.2
Ten Years	24	12.1

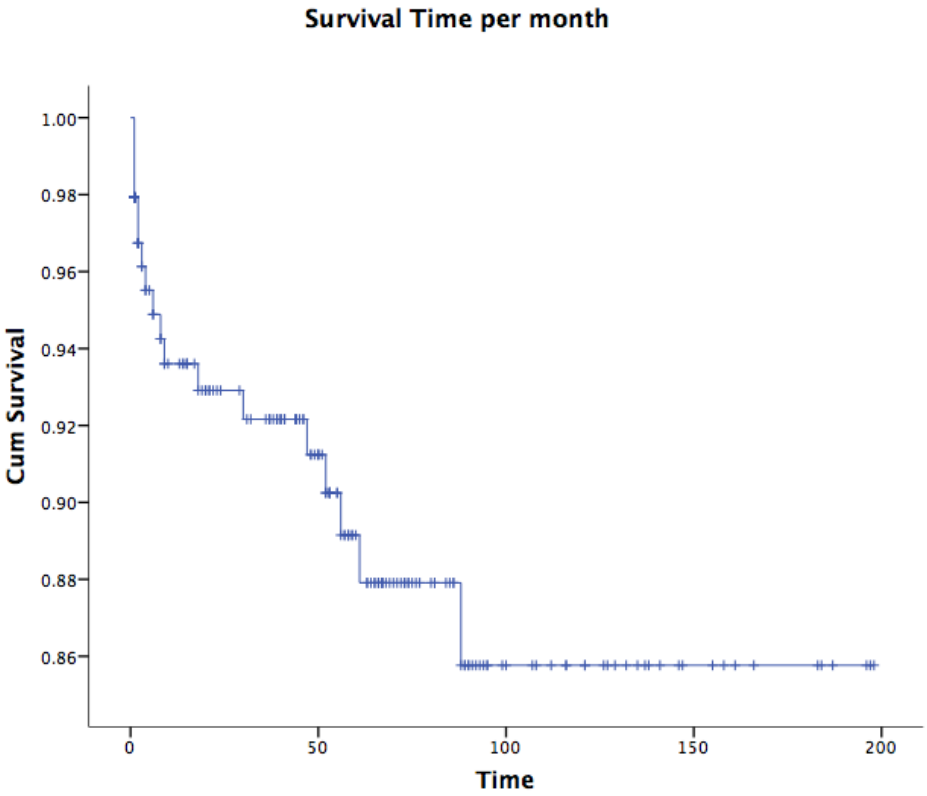

Figure 1:-

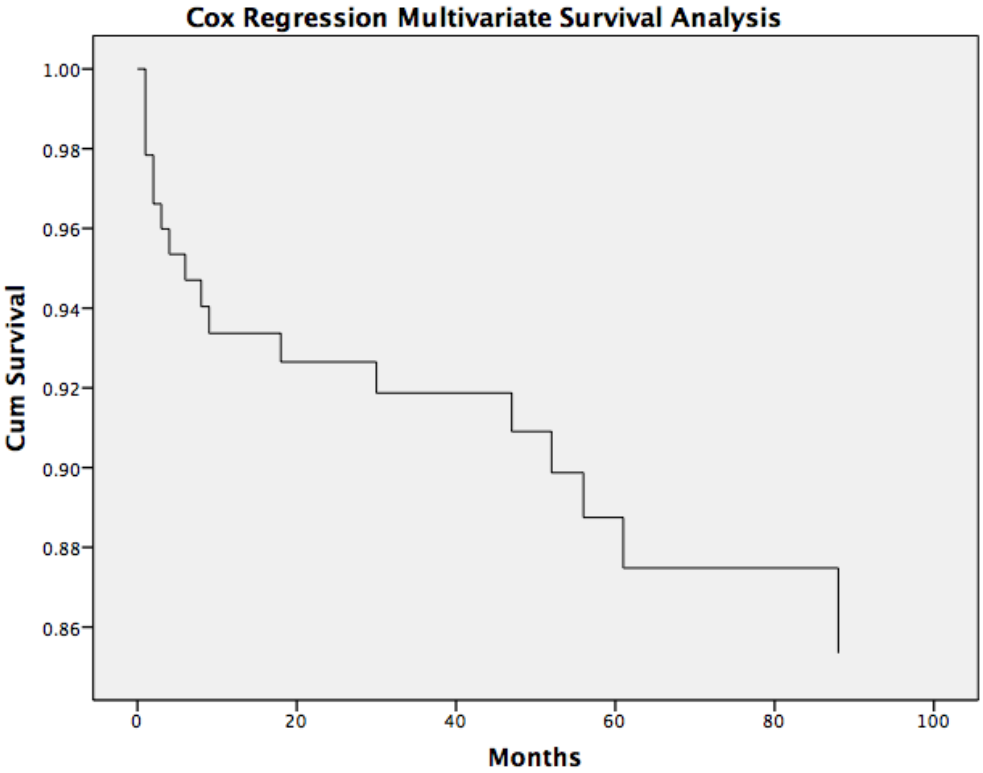

Figure 2:-

Discussion:-

Our study showed an excellent outcome for patients who underwent tricuspid valve surgery. Our results were consistent with a 2013 review by Al-Atassi et al., who strongly recommended tricuspid valve repair whenever possible.Their recommendation was based on a definite improvement in patient status.[6]. To the best of our knowledge, this is the first study from Saudi Arabia that addresses this topic; therefore, we do not have any local data for comparison. In clinical practice, clinical improvement in patient status is the target achievement of tricuspid valve surgery. This is primarily monitored by ECHO data, according to a review paper published by Huttin et al., in 2016.[7] We followed the same regimenwith our patients, who were monitored after surgery by frequent ECHO studies that were interpreted by a certified cardiologist. This should lead to a definite enhancement in patient care, and should diagnose any recurrence at an early stage. A meta-analysis conducted by Kara et al. in 2015 included 2,488 patients from 10 studies and revealed a significant reduction of tricuspid valve disease progression in those who underwent a surgical repair.[8]

Unfortunately, we did not consider the cause of death, which would have provided more information about risk factors for survival. Patients who were re-operated on survived. Time and cause for re-operation were not measured.

Conflicts of Interest:-

The author(s) of this publication has no research support from any source. This project was reviewed and approved by the King Abdullah International Research Center, Riyadh, Saudi Arabia, in accordance with its research policy.

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